KOHLER® Power Systems

Engine Model XXxxxx

Liquefied Petroleum Gas (LPG) or LPG / Natural Gas (NG) Fueled

Operation Manual TP-6901

Proprietary
Photo
Draft

Important: Read all safety precautions and instructions carefully before operating equipment.
Refer to the operating instructions of equipment that this engine powers.
Ensure that the engine is stopped before performing any maintenance or service.

Record Engine Information to reference when ordering parts or obtaining warranty coverage.

Engine Model _____

Specification _____

Serial Number _____

Purchase Date _____

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Safety Precautions

WARNING: A hazard that could result in death, serious injury, or substantial property damage.

CAUTION: A hazard that could result in minor personal injury or property damage.

NOTE: Used to notify people of important installation, operation, or maintenance information.

WARNING

Explosive Fuel can cause fires and severe burns.

If a gaseous odor is detected, ventilate area and contact an authorized service technician.

LPG is extremely flammable and is heavier than air and tends to settle in low areas where a spark or flame could ignite gas. Do not start or operate this engine in a poorly ventilated area where leaking gas could accumulate and endanger safety of persons in area.

NG is extremely flammable, is lighter than air, and rises. Do not start or operate this engine in a poorly ventilated area where leaking gas could accumulate and endanger safety of persons in area.

To ensure personal safety, installation and repair of LPG/NG fuel supply systems must be performed only by qualified LPG/NG system technicians. Improperly installed and maintained LPG / NG equipment could cause fuel supply system or other components to malfunction, causing gas leaks.

Observe federal, state and local laws governing LPG / NG fuel, storage, and systems.

WARNING

Carbon Monoxide can cause severe nausea, fainting or death.

Avoid inhaling exhaust fumes.

Engine exhaust gases contain poisonous carbon monoxide. Carbon monoxide is odorless, colorless, and can cause death if inhaled.

WARNING

Rotating parts can cause severe injury.

Stay away while engine is in operation.

Keep hands, feet, hair, and clothing away from all moving parts to prevent injury. Never operate engine with covers, shrouds, or guards removed.

CAUTION

Electrical shock can cause injury.

Do not touch wires while engine is running.

WARNING

Accidental Starts can cause severe injury or death.

Disconnect and ground spark plug lead(s) before servicing.

Before working on engine or equipment, disable engine as follows: 1) Disconnect spark plug lead(s). 2) Disconnect negative (-) battery cable from battery.

Before disconnecting negative (-) ground cable, make sure all switches are OFF. If ON, a spark will occur at ground cable terminal which could cause an explosion if hydrogen gas or LPG / NG fuel vapors are present.

WARNING

Hot Parts can cause severe burns.

Do not touch engine while operating or just after stopping.

Never operate engine with heat shields or guards removed.

California Proposition 65 Warning

Engine exhaust from this product contains chemicals known to the State of California to cause cancer, birth defects, or other reproductive harm.

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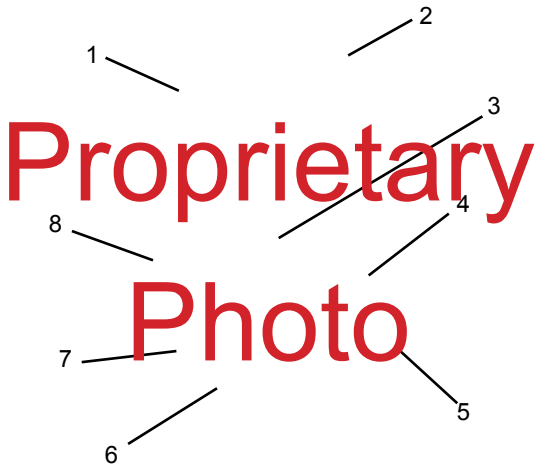

Figure 1 Front View of the Engine

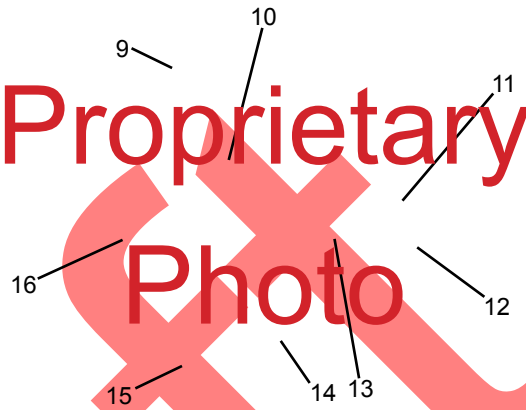

Figure 2 Top View of the Engine

Figure 3 Right View of the Engine

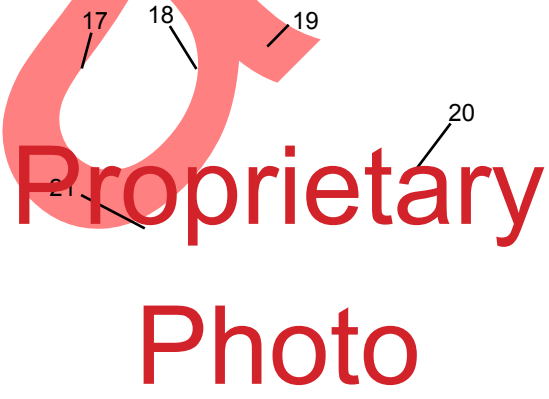

Figure 4 Left View of the Engine

1	Oil Dipstick	8	Timing Gear Case	15	Oil Filter	22	Rear Hanger
2	Air-Fuel Mixer	9	Intake Manifold	16	Valve Cover	23	Spark Plug Recesses
3	Water Pump	10	MAP Sensor	17	Front Hanger	24	Spark Plug Wires
4	V-Belt	11	Coolant Temperature Sensor	18	Throttle Body	25	Oil Pressure Switch
5	Alternator	12	Water Inlet	19	Fuel Valve	26	Oil Pan
6	Crankshaft Pulley	13	Oil Filler Cap	20	Exhaust Manifold	27	Oil Pan Drain Plug
7	Crankshaft Sensor	14	Ignition Coil	21	Water Outlet	28	Starter

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Pre-Start Checklist

NOTE: Operators must read this manual carefully before starting the engine. Starting the engine according to this manual is important.

1. Check all parts of the engine carefully.
2. Tighten pipe connectors and check the tension of the fan belt. See Figure 14 Check the V-Belt Surface and Tension.
3. Check oil level by using the oil dipstick and check oil for deterioration or aging. See Figure 7 Check Oil Level.

NOTE: The lower mark on the dipstick is the caution level, not the use level, fill with sufficient oil to avoid engine failure.

4. Check the fuel level in the fuel tank (LPG only) and check the fuel pipe and connectors in the fuel supply system. If LPG tank is low, have it refilled.
5. Check the connections on the battery for propper connection and corrosion.
6. Check and clean cooling areas, air intake areas and external surfaces of engine (particularly after storage).
7. Check that air cleaner components and all shrouds, equipment covers, and guards are in place and securely fastened.
8. Check every connector on the battery, alternator, starter, spark plug, and ignition coil.

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Engine Operation

⚠ WARNING

Carbon Monoxide can cause severe nausea, fainting or death.

Avoid inhaling exhaust fumes.

Engine exhaust gases contain poisonous carbon monoxide. Carbon monoxide is odorless, colorless, and can cause death if inhaled.

⚠ WARNING

Rotating parts can cause severe injury.

Stay away while engine is in operation.

Keep hands, feet, hair, and clothing away from all moving parts to prevent injury. Never operate engine with covers, shrouds, or guards removed.

Starting Procedure

NOTE: Do not approach or attempt to disassemble parts while the engine is running. If adjustments must be made, use caution.

NOTE: Do not remove the radiator cap when it is hot as there is high pressure in the radiator system.

Refer to operating instructions of equipment this engine powers for specific starting instructions.

Cold Weather Starting

1. Use proper oil for the ambient temperature. See Figure 8 Oil Recommendations by Temperature.
2. Disconnect electrical load before starting.

Angle of Operation

Refer to operating instructions of equipment this engine powers. Do not operate this engine exceeding maximum angle of operation; see specification table. Engine damage could result from insufficient lubrication.

Check While the Engine is Running

NOTE: Check often for abnormal noise while the engine is running.

NOTE: Check for leakage from fuel pipes, cooling pipes, or air pipes. If there is leakage, stop the engine and repair.

1. Check for detonation, backfire, knocking, loose parts or connections, or other abnormal noise.
2. Check for a burnt smell from hot electric equipment.
3. Check for leakage from fuel system, cooling system, or lubricating system.
4. Check oil pressure, coolant temperature, and fuel tank level (LPG only).

Stopping

1. If possible, remove load by disengaging all PTO driven attachments.
2. Refer to operating instructions of equipment this engine powers for specific stopping instructions.

NOTE: If there are issues such as low oil pressure, no oil pressure, high coolant temperature, or abnormal noise, stop the engine immediately.

Engine Speed

NOTE: Do not tamper with the governor settings to increase the maximum engine speed, doing so may result in engine overspeed. Overspeed is hazardous and will void warranty.

Engine speed control is maintained by the engine's Electronic Control Module (ECM). Defaults programmed into the ECM software and throttle position sensors allow the ECM to maintain safe operating control over the engine while maintaining speed and load control.

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Engine Maintenance

⚠ WARNING

Accidental Starts can cause severe injury or death.

Disconnect and ground spark plug lead(s) before servicing.

Before working on engine or equipment, disable engine as follows: 1) Disconnect spark plug lead(s). 2) Disconnect negative (-) battery cable from battery.

Before disconnecting negative (-) ground cable, make sure all switches are OFF. If ON, a spark will occur at ground cable terminal which could cause an explosion if hydrogen gas or LPG / NG fuel vapors are present.

As the engine is used, parts may become worn, bolts may loosen, clearances change, and oil can become contaminated. The condition of the Kohler® model XXxxxx engine will change over time, and issues such as hard starting, decreased power, increased fuel consumption, etc. may occur with wear. According to the technical state and accumulative working time of the engine, some technical maintenance may be necessary. In order to keep the engine in good working order, avoid or reduce issues, and to prolong the life of the engine, users must complete the following technical maintenance carefully.

NOTE: In order to keep the engine working stably, follow all technical maintenance procedures.

Performing Technical Maintenance

NOTE: Only after the engine stops running can you measure the correct level of engine fluids.

NOTE: Never fill the battery completely with water or use dirty water of any kind. If you do, it can cause the battery to be undercharged and it may not work as usual.

NOTE: Do not mix different brands or grades of oil.

Maintenance Schedule

Due to the wear that different parts accumulate at different speeds, there are four grades of technical maintenance for this engine:

Every 10 Hours of Operation
Every 20 Hours of Operation
Every 60 Hours of Operation
Every 120 Hours of Operation

Figure 5 Maintenance Schedule Intervals

Preform maintenance on each item in the maintenance schedule at the designated intervals for the life of the engine. For example, an item requiring service every 8 hours, requires service after 16 hours, 24 hours, and so on.

Maintenance Schedule
Every 10 Hours of Operation
• Check fluid levels and battery
• Check for leakage
• Check electrical connections for tightness
• Listen to engine noises
Every 20 Hours of Operation
• Check battery's voltage
• Clean the air filter
• Check all bolts for tightness
Every 60 Hours of Operation
• Check electrode of spark plug and adjust gap if necessary
• Replace air filter
Every 120 Hours of Operation
• Check the battery for cracking
• Check the alternator belt tension and adjust if necessary
• Replace oil and oil filter
Seasonal Maintenance
• Check the antifreeze concentration
• Replace oil with cold temperature oil in the winter, if required

Figure 6 Maintenance Schedule

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Lubrication System

Check Oil

NOTE: Use oil according to this manual.

NOTE: Shorten the oil change interval if the engine is run continually in dirty places.

Regularly check the engine's oil. If oil is deteriorating, discoloring, thinning, or there is water present, the quality of the oil has been compromised and it should be replaced.

Check Oil Level

NOTE: In addition to checking oil pressure, also check the oil level before running the engine after certain periods of time. See Figure 6 Maintenance Schedule.

1. Stop engine and wait for oil level to stabilize.
2. Pull out the oil dipstick.
3. Clean the oil dipstick with a dry clean cloth.
4. Re-insert the oil dipstick into the engine.
5. Pull out the oil dipstick again to check the oil level.

Maintain the oil level between the F ("full") and L ("low") marks on the dipstick. If the oil level is lower, check for leakage and fill oil up to the F mark. See Figure 7 Check Oil Level, Figure 9 Removing the Oil Filler Cap and Figure 10 Oil Filling Pipe and Filling Engine Oil.

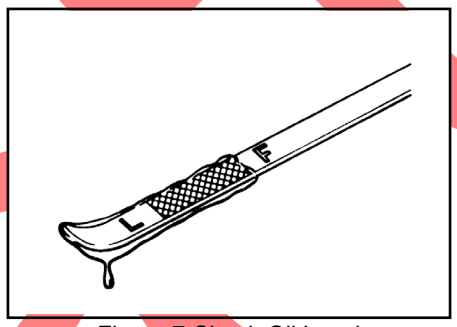

Figure 7 Check Oil Level

Oil Recommendations

NOTE: Do not mix different brands or types of oil

NOTE: Do not over or under fill the engine's lubrication system with oil. See Figure 19 Engine Specifications.

Synthetic oil is recommended for use in LPG/NG fueled engines. We recommend use of Kohler oils for best performance, see Figure 19 Engine Specifications. Other high-quality detergent oils (including synthetic) of API (American Petroleum Institute) service class SJ or higher are acceptable. Select viscosity based on air temperature at time of operation as shown in Figure 8 Oil Recommendations by Temperature.

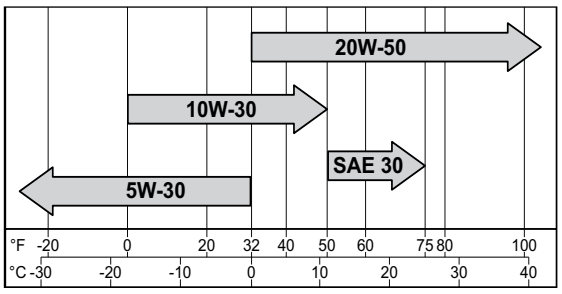

Figure 8 Oil Recommendations by Temperature

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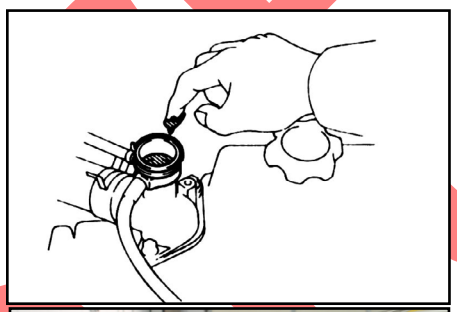
Replace With New Oil

NOTE: Each time you change the engine oil, run the engine without load for a short time after to ensure that each friction surface has oil.

NOTE: Change oil while engine is warm.

1. Drain all used oil.
   - Remove the oil filter cap from the top of the cylinder head cover. See Figure 9 Removing the Oil Filler Cap.
   - Prepare a drain pan for drained oil. See Figure 11 Removing the Oil Filter.
   - Remove the oil pan drain plug
   - Allow oil to drain.
   - Replace the oil pan drain plug
2. Fill with new oil.
   - Remove the oil filler cap. See Figure 9 Removing the Oil Filler Cap..
   - Refill oil from oil filler cap. See Figure 10 Oil Filling Pipe and Filling Engine Oil.
   - Replace the oil filler cap.
3. Check the oil level. See Figure 7 Check Oil Level.
4. Tighten the oil filling cap after refilling the oil.

Figure 9 Removing the Oil Filler Cap



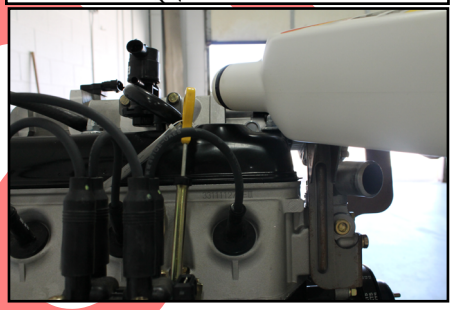


Figure 10 Oil Filling Pipe and Filling Engine Oil

Oil Pump

The oil pump is a rotor type, housed in the oil pan. It is located at the bottom of the cylinder block near the front and is driven by an oil pump drive device.

NOTE: If the pressure in the lubrication system drops or fluctuates, stop the engine and find the cause.

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Replace the Oil Filter

The oil filter is a rotating type oil filter with whole body and paper filter element. Tighten it at the seat using the appropriate wrench.

NOTE: Do not reuse an oil filter; do not use the same filter repeatedly. Always use a new filter.

1. Using the appropriate oil filter wrench, remove the oil filter. See Figure 11 Removing the Oil Filter.
2. Check and clean the oil filter installation surface. Apply clean engine oil to the gasket of a new oil filter. See Figure 12 Cleaning a New Oil Filter Before Installation.
3. Lightly screw in the oil filter by hand until you feel resistance. Then, using the appropriate oil filter wrench, tighten it another ¾ turn. See Figure 13 Installing the Oil Filter.

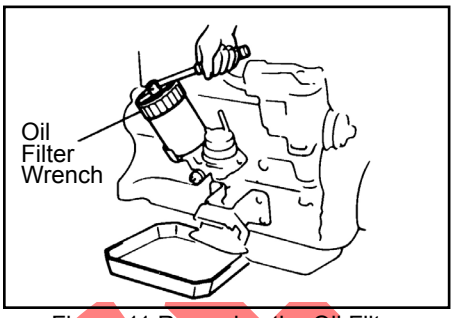

Figure 11 Removing the Oil Filter

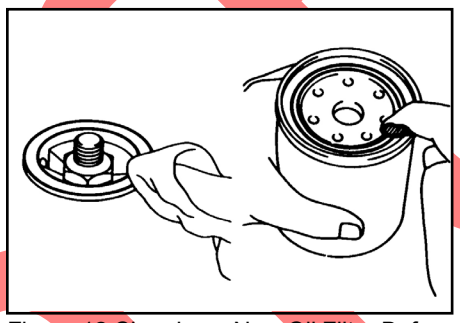

Figure 12 Cleaning a New Oil Filter Before Installation

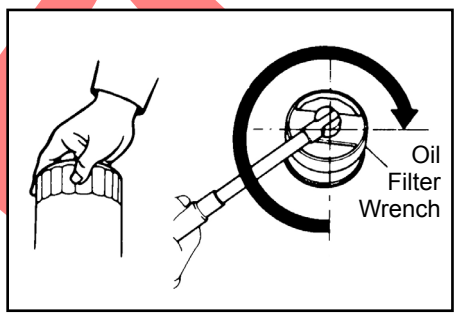

Figure 13 Installing the Oil Filter

Adding Oil

NOTE: Before refilling oil, clean the oil filler cap to avoid impurities entering into the engine.

Refill oil from oil filler cap at the top of the cylinder head cover. See Figure 9 Removing the Oil Filler Cap and Figure 10 Oil Filling Pipe and Filling Engine Oil.

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Engine Cooling

⚠ WARNING

Hot Parts can cause severe burns.

Do not touch engine while operating or just after stopping.

Never operate engine with heat shields or guards removed.

V-Belt

V-belts are generally tensioned by adjusting the alternator, or through a mechanical belt tensioner. To check the tension of the v-belt, push the belt down at the midway between pulleys. See Figure 14 Check the V-Belt Surface and Tension and Figure 21 Adjustment Parameters.

Inspecting the V-Belt

1. Inspect the belt visually for separation or damage. If any abnormality is found, replace the belt.
2. Inspect belt tension and deflection. If the flexure of the belt does not meet the standards in Figure 21 Adjustment Parameters, adjust the v-belt by the following procedure.

Adjusting the V-Belt

1. Loosen the retaining bolts of the alternator and adjusting rod.
2. Loosen the upper and lower lock nuts on the adjusting rod.

NOTE: The lower nut on the adjusting rod had left hand threads.

3. Turn the adjusting rod to adjust the belt tension. If the tension of the belt does not meet the standards in Figure 21 Adjustment Parameters, adjust the belt.
4. Tighten the upper and lower lock nuts.
5. Tighten all retaining bolts on the alternator and adjusting plate.

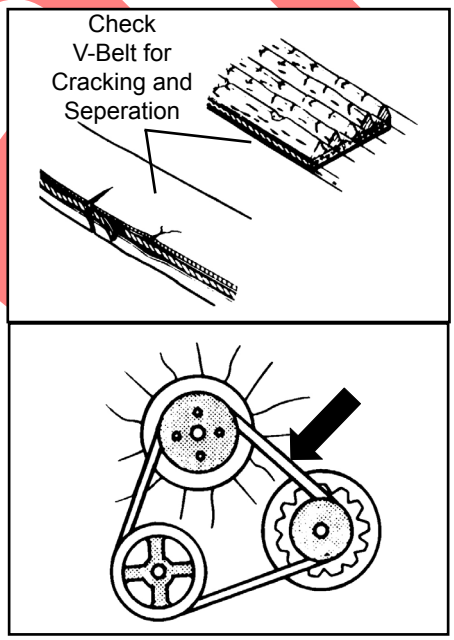

Figure 14 Check the V-Belt Surface and Tension

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⚠ WARNING

Explosive Fuel can cause fires and severe burns.

If a gaseous odor is detected, ventilate area and contact an authorized service technician.

LPG is extremely flammable and is heavier than air and tends to settle in low areas where a spark or flame could ignite gas. Do not start or operate this engine in a poorly ventilated area where leaking gas could accumulate and endanger safety of persons in area.

NG is extremely flammable, is lighter than air, and rises. Do not start or operate this engine in a poorly ventilated area where leaking gas could accumulate and endanger safety of persons in area.

To ensure personal safety, installation and repair of LPG/NG fuel supply systems must be performed only by qualified LPG/NG system technicians. Improperly installed and maintained LPG / NG equipment could cause fuel supply system or other components to malfunction, causing gas leaks.

Observe federal, state and local laws governing LPG / NG fuel, storage, and systems.

This engine is certified to operate on LPG or NG.

LPG Engines

LPG from an appropriate LPG fuel tank (supplied separately) is required to operate this engine.

NG Engines

NG from an approved system or source of supply can be used to operate this engine.

LPG or NG Fuel System Conversion

NOTE: Before performing any service to the fuel system, temporarily disconnect the battery and shut off the fuel supply for safety.

The system configuration for LPG or NG requires a mechanical setting on the pressure regulator and an electrical setting for the ECM to insure proper fuel and spark timing is supplied to the engine. The pressure regulator is pre-set at the factory for NG, so when using NG no mechanical adjustment is required.

To set the regulator for LPG:

1. Lift the lower cylinder of the regulator.
2. Turn the cylinder ¼ turn to the __.
3. Let go of the cylinder and allow it to settle into place.

To set the regulator for NG:

1. Lift the lower cylinder of the regulator.
2. Turn the cylinder ¼ turn to the __.
3. Pull down the lower cylinder to full extension.

Fuel Pressure Regulator

The fuel pressure regulator regulates the pressure of NG or LPG fuel as it enters the mixer.

Air-Fuel Mixer

The mixer is an air valve design that uses a drop in pressure to draw fuel into the mixer during cranking and continue into full load.

The mixer is equipped with a low speed mixture adjustment which is retained in a tamper-proof housing. The mixer is preset at the factory and should not require adjustment.

Never disassemble or rebuild the air-fuel mixer. The air-fuel mixer is an emission control device. Components inside the mixer are specifically calibrated to meet the engine's emissions requirements. If the mixer fails to function correctly, replace it.

LPG Regulator

In compliance with government emission standards, a fuel regulator is added to the engine at the factory to provide proper fuel supply to the engine.

Do not make adjustments to the fuel regulator. A Kohler Authorized dealer or qualified LPG personnel must perform all service related to the fuel regulator.

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⚠ CAUTION

Electrical shock can cause injury.

Do not touch wires while engine is running.

Spark Plugs

Spark plugs should be replaced at the recommended intervals as described in, Figure 6 Maintenance Schedule. Use only the recommended spark plug or an equivalent as described in Figure 20 Specifications of Main Components.

1. Use a spark plug wrench to remove the spark plug(s) (4). See Figure 15 Removing the Spark Plugs and Tubes.
2. Clean out the spark plug recess.
3. Check each spark plug's gap using a wire feeler gauge. See Figure 16 Inspecting the Spark Plug Gap.
4. Adjust the spark gap if necessary. See Figure 21 Adjustment Parameters.
5. Install spark plugs (4) into cylinder head.
6. Torque the spark plug(s) according to Figure 22 Tightening Torque of Main Components.

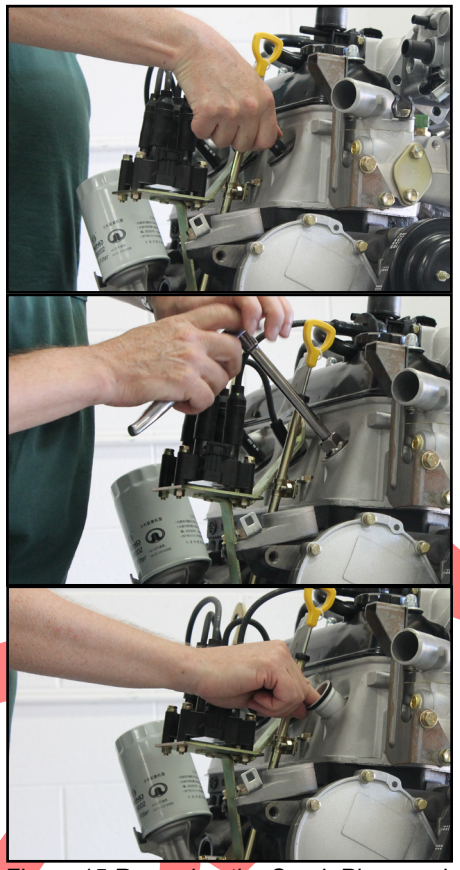

Figure 15 Removing the Spark Plugs and Tubes

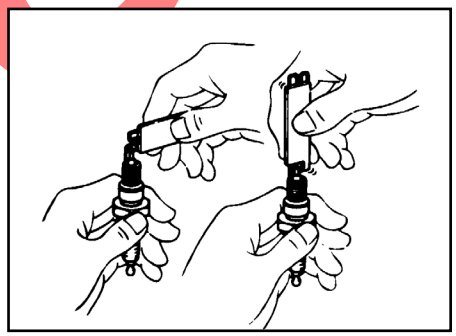

Figure 16 Inspecting the Spark Plug Gap

Ignition System

This engine has an electronic ignition system.

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Related Literature

Figure 17 Related Literature identifies related literature available for the model XXxxxx engine. Only trained and qualified personnel should install or service this engine.

Literature Type	Part Number
Kohler Model XXxxxx Service Manual	TP-6902
Kohler Model XXxxxx Service Manual / Troubleshooting / Code Diagnostics	TP-6903
Kohler Model XXxxxx Service Parts Manual	TP-6904

Figure 17 Related Literature

Troubleshooting

NOTE: Do not attempt to service or replace major engine components, or any items that require special timing or adjustment procedures. This work should be performed by a Kohler authorized dealer.

Fuel System Leakage Check

With the fuel valve fully opened and the engine turned off, check all fuel system connections and lines for leaks using a soapy water solution Correct any leaks before restarting the engine. Have any necessary service performed by a Kohler authorized dealer or qualified LPG / NG personnel only.

	Possible Cause						
Problem	No Fuel	Improper Fuel	Dirt in Fuel Line	Incorrect Oil Level	Engine Overloaded	Faulty Spark Plug	Dirty / Restricted Regulator
Will Not Start	•	•	•	•	•	•	•
Hard Starting	•	•	•	•	•	•	•
Stops Suddenly	•		•	•	•		•
Lacks Power		•	•	•	•	•	•
Operates Erratically		•	•		•	•	•
Knocks or Pings		•			•	•	•
Skips or Milfires		•	•			•	•
Backfires		•	•			•	•
Overheats		•	•	•	•		•
High Fuel Consumption						•	

Figure 18 General Troubleshooting

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Engine Specifications

Item	Specifications
Engine Model	XXxxxx
Block Type	I-4
Number of Cylinders	4
Cylinder Bore	91 mm (3.5 in)
Piston Stroke	86 mm (3.4 in)
Displacement	2.2 L (2.3 qts)
Rated Output	61 kW / 3600 rpm
Oil Brand	
Rotating Direction of Crankshaft	Counterclockwise (face to flywheel)
Compression Ratio	10.5:1
Cylinder Fire Order	1-3-4-2
Lubricating Style	Pressurized
Starting Style	Electric starting
Oil Dry Fill Capacity	4.2 L (4.4 qts)
Net Weight	145 kg (319.7 lbs)
Overall Dimension (L×W×H)	826 × 547 × 647 mm (32.5 × 21.5 × 25.5 in)

Figure 19 Engine Specifications

Specifications of Main Components

Item	Specifications
Oil Filter / Breather	Paper, Valve Covers, Top Oil Filler
Oil Pump	Rotor type
Water Pump	Centrifugal type, No fan
Flywheel	Flywheel with attachment provisions for flywheel adapter GM88832
Thermostat	Valve open 76 °C (169 °F), valve lift fully open at 88 °C (190 °F)
Alternator	Rated voltage 14 V, current 90 A
Electric Starter	1.2 kW, speed reduction type
Ignition System	Electronic
Spark Plug	

Figure 20 Specifications of Main Components

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Adjustment Parameters

Item	Specifications
Spark Plug Gap	0.7 - 0.8 mm (0.027 - 0.031 in)
Fan Belt Tension	At the pressure of 98 N, the deflection of new belt is 5 - 7 mm (0.20 - 0.28 in), an old belt is 7 - 8 mm (0.28 - 0.31 in).

Figure 21 Adjustment Parameters

Tightening Torque of Main Components

Main Fastening Parts	N•m	ft•lb
Spark Plug - Cylinder Head	18	13.3
Oil Pan Drain Plug	20 - 25	14.8 - 18.4

Figure 22 Tightening Torque of Main Components

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For the nearest KOHLER authorized installation, service, and sales dealer in the US and Canada:
Call 1-800-544-2444 or visit
KOHLERPower.com

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